vations at the same place show how little correctness the mean of them, or the result, however obtained, can pretend to.

The results of the recent observations, with which the author has been furnished by various navigators and by the Hydrographer's Office, have been obtained by throwing the observations into curves, according to methods formerly used and described by the author. This labour has been carefully performed by Mr. D. Ross of the Hydrographer's Office.

January 6, 1848.

GEORGE RENNIE, Esq., Treasurer, in the Chair.

"On Terrestrial Magnetism." By William A. Norton, A.M., M.A.P.S., Professor of Mathematics and Natural Philosophy in Delaware College, United States of America. Communicated by Lieut.-Colonel Edward Sabine, R.A., For. Sec. R.S.

The object of the author in the present memoir is to show that, by adopting certain fundamental conceptions with respect to the terrestrial magnetic forces, the magnetic may be deduced from the thermal elements of the earth. The following are the propositions which he considers he has established by his inquiries.

1. All the magnetic elements of any place on the earth may be deduced from the thermal elements of that place; and all the great features of the distribution of the earth's magnetism may be theoretically derived from certain prominent features in the distribution of its heat.

2. Of the magnetic elements, the horizontal intensity is nearly proportional to the mean temperature, as measured by Fahrenheit's thermometer; the vertical intensity is nearly proportional to the difference between the mean temperatures, at two points situated at equal distances north and south of the place, in a direction perpendicular to the isothermal line; and, in general, the direction of the needle is nearly at right angles to the isothermal line, while the precise courses of the inflected line, to which it is perpendicular, may be deduced from Sir David Brewster's formula for the temperature, by differentiating and putting the differential equal to zero.

3. As a consequence, the laws of the terrestrial distribution of the physical principles of magnetism and heat must be nearly the same; and these principles themselves must have towards one another the most intimate physical relations.

4. The principle of terrestrial magnetism, in as far as the phenomena of the magnetic needle are concerned, must be confined to the earth's surface, or to a comparatively thin stratum of the mass of the earth.

5. The mathematical theory of terrestrial magnetism which has been under discussion must be true in all its essential features.

6. We may derive the magnetic elements by very simple formulæ, and with an accuracy equal to that of Gauss's formulæ, from a very

small number of magnetic data determined by observation, and the mean annual temperature of the place.

January 13, 1848.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Disruptive Discharge of accumulated Electricity, and the Proximate Cause of Lightning." By Isham Baggs, Esq. Communicated by S. Hunter Christie, Esq., Sec. R.S.

The author proposes to inquire into the principal causes of the violent and disruptive union of opposite electricities which constitutes the electric discharge; and to apply the knowledge thus gained to the explanation of natural phenomena, and the further proof of the identity of frictional and voltaic electricities. He describes two instruments which he employed for the purpose of regulating the discharges of a Leyden jar, or battery, by adjusting with precision the distances between two brass balls, forming a communication between the inner and outer coatings; allowing of their being charged only to a limited degree of intensity, by carrying off all the electricity beyond that extent; and thus guarding the glass from the dangers of fracture from an excess of charge. He is led to the conclusion, that with a given dialectric, such as glass, the limit to the intensity of the charge it can receive varies directly as the cube of its thickness, being in the compound ratio of the resistance it presents to the discharge, which is simply as the thickness, and of the square of the distance of the two charged surfaces, such being the law of electric action.

When a number of insulated Leyden jars, arranged in a consecutive series by connecting the outer coating of each with the inner coating of the next, is charged by means of an electrical machine, the tension of the charge diminishes in each jar as they follow in the series, that of the terminal jar being exceedingly small. On the other hand, when each jar has been charged separately in the same manner and to an equal extent, and then quickly arranged in a series, the jars not touching one another, but the knobs connected with the inner coating of each jar, after the first, being placed at a certain distance from the outer coating of the preceding jar, which in such an arrangement is charged with an electricity of an opposite kind to that of the knob adjacent to it, the author found that the tension of the electricities was greatly augmented, giving rise to violent explosions whenever a discharge occurred. He considers a battery thus constituted as bearing the same relation to a single Leyden jar as the voltaic pile does to a single galvanic circle; and as affording in like manner the means of exalting, to any assignable degree, the electric tension. Adopting the views of Mr. Crosse as to the constitution of a thunder-cloud, namely, that it is formed of a number of concentric zones of electricity, alternately positive and negative,